

1 CLAIMS:

2 Having thus described our invention, what we claim as
3 new and desire to secure by Letters Patent is as
4 follows:

5 1. A method for filling vias in a wafer, comprising:
6 evacuating air from the vias;
7 trapping at least a portion of the wafer and a
8 paste for filling the vias between two surfaces; and
9 pressurizing the paste to fill the via.

10 2. The method as recited in claim 1, further
11 comprising forming a seal between the surfaces so as to
12 enclose said portion of the wafer and said paste.

13 3. The method as recited in claim 2, further
14 comprising moving the seal over successive portions of
15 the wafer to fill the vias.

16 4. The method as recited in claim 1, further
17 comprising:

18 placing the paste on a planar surface facing the
19 wafer; and

20 moving the planar surface upon which the paste is
21 placed into contact with the wafer.

22 5. The method as recited in claim 1, further
23 comprising injecting the paste between one of said
24 surfaces and the wafer.

1 6. The method as recited in claim 1, further
2 comprising injecting the paste between one of said
3 surfaces and the wafer after evacuating the air from
4 said vias.

5 7. The method as recited in claim 1, further
6 comprising:

7 providing an evacuated space between said
8 surfaces; and

9 forcing said surfaces together to force said paste
10 into the vias.

11 8. The method as recited in claim 7, wherein said
12 surfaces are forced together by atmospheric pressure.

13 9. The method as recited in claim 1, wherein the paste
14 is pressurized to greater than atmospheric pressure.

15 10. The method as recited in claim 1, wherein the paste
16 is pressurized to a pressure in the range of 10 to 100
17 PSI.

18 11. The method of claim 1, wherein said vias are blind
19 vias.

20 12. An apparatus for filing vias in a wafer,
21 comprising:

22 a chamber in which to place the wafer, said
23 chamber being capable of being evacuated;

1 a surface upon which to place said wafer;
2 a paste delivery portion for providing a paste to
3 fill said vias; and
4 a paste filling portion for bringing said paste
5 into contact with said vias under pressure so that said
6 paste fills said vias.

7 13. The apparatus as recited in claim 12, wherein said
8 paste filling portion provides said paste at a pressure
9 with the range of 10 to 100 PSI.

10 14. The apparatus as recited in claim 12, wherein said
11 paste delivery portion comprises:

12 a surface onto which said paste is deposited; and
13 a mechanism for applying pressure so that said
14 paste on said surface is forced into contact with said
15 wafer.

16 15. The apparatus as recited in claim 14, wherein said
17 paste delivery portion comprises:

18 a surface onto which said paste is deposited; and
19 a passageway through which said paste is delivered
20 to said surface.

21 16. The apparatus as recited in claim 14, wherein said
22 mechanism for applying pressure comprises:

23 a plate which defines said surface; and
24 components for applying a pressure differential to
25 said plate so as to force said plate toward said wafer.

1 17. The apparatus as recited in claim 16, further
2 comprising a compliant material on said surface to
3 which said paste is applied.

4 18. The apparatus as recited in claim 12, wherein said
5 paste filling portion comprises:

6 a plate having a portion for receiving said paste;

7 a first seal for sealing said plate to said
8 surface upon which said wafer is placed;

9 a second seal for sealing said paste between said
10 plate and said plate and said wafer; and

11 a mechanism for forcing said plate towards said
12 wafer so that said paste is forced into said vias of
13 said wafer.

14 19. The apparatus as recited in claim 18, wherein said
15 mechanism for forcing said plate towards said wafer
16 comprises:

17 gas removal apparatus for evacuating gas between
18 said plate and said surface upon which said wafer is
19 placed; and

20 gas replacement apparatus for replacing gas
21 evacuated from said chamber.

22 20. The apparatus as recited in claim 19, wherein said
23 gas replacement apparatus comprises an opening through
24 which gas is permitted to enter said chamber.

1 21. The apparatus as recited in claim 12, wherein said
2 surface upon which to place said wafer comprises a base
3 plate having a recess for said wafer.

4 22. The apparatus as recited in claim 21, wherein said
5 surface upon which to place said wafer comprises a
6 surface of an electrostatic chuck.

7 23. The apparatus as recited in claim 12, wherein said
8 paste delivery portion comprises a pressurized paste
9 reservoir.

10 24. The apparatus as recited in claim 12, wherein said
11 paste filling portion comprises:

12 a piston housing having an opening for receiving a
13 piston;

14 a compliant seal for sealing said piston housing
15 to a portion of said wafer so as to confine said paste;

16 a piston disposed in said piston housing; and

17 a piston actuator for forcing said piston toward
18 said wafer;

19 wherein said paste delivery portion provides said
20 paste to said opening.

21 25. The apparatus as recited in claim 24, further
22 comprising:

23 a mechanism for moving said piston housing so that
24 said seal is compressed for filing said vias.

1 26. The apparatus as recited in claim 25, wherein said
2 mechanism for moving said piston housing further moves
3 said piston housing to a position wherein said seal is
4 compressed to a lesser degree than when said vias are
5 filled, to thereby allow said piston housing to be
6 moved so that said piston housing is disposed so as to
7 be in a position to fill vias of one or more successive
8 portions of said wafer with paste delivered to said
9 opening.

10 27. The apparatus as recited in claim 24, further
11 comprising a mechanism for cleaning said piston of
12 excess paste after vias of a wafer have been filled.

13 28. The apparatus as recited in claim 12, wherein said
14 paste filling portion comprises:

15 an elongate member having a surface with a slot
16 through which paste is provided to said wafer; and

17 a compliant seal for sealing said surface to said
18 wafer.

19 29. The apparatus as recited in claim 28, further
20 comprising a mechanism for translating said member and
21 said wafer with respect to one another so as to fill
22 vias in successive portions of said wafer.

23 30. The apparatus as recited in claim 28, further
24 comprising a mechanism for rotating said member and
25 said wafer with respect to one another so as to fill
26 vias in successive portions of said wafer.

1 31. The apparatus as recited in claim 30, wherein said
2 mechanism for rotating said member and said wafer with
3 respect to one another comprising a rotating base
4 having said surface upon which said wafer is placed.

5 32. The apparatus as recited in claim 28, configured
6 to accept a circular wafer, wherein said elongate
7 member is disposed radially with respect to said wafer.

8 33. The apparatus as recited in claim 32, wherein said
9 elongate member has a length less than that a radius of
10 said wafer, wherein said apparatus further comprises:

11 a mechanism for rotating said wafer; and

12 a mechanism for radially translating said member
13 in a radial direction with respect to said wafer.

14 34. The apparatus as recited in claim 33, wherein said
15 mechanism for rotating said wafer includes a rotation
16 speed control to control speed of rotation of said
17 wafer.

18 35. The apparatus as recited in claim 33, wherein said
19 mechanism for radially translating said member includes
20 a translation speed control to control speed of
21 translation of said member with respect to said wafer.

22 36. The apparatus as recited in claim 33, wherein said
23 mechanism for radially translating said member includes
24 a worm gear assembly, and a motor for rotating a drive
25 shaft of said assembly.